

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



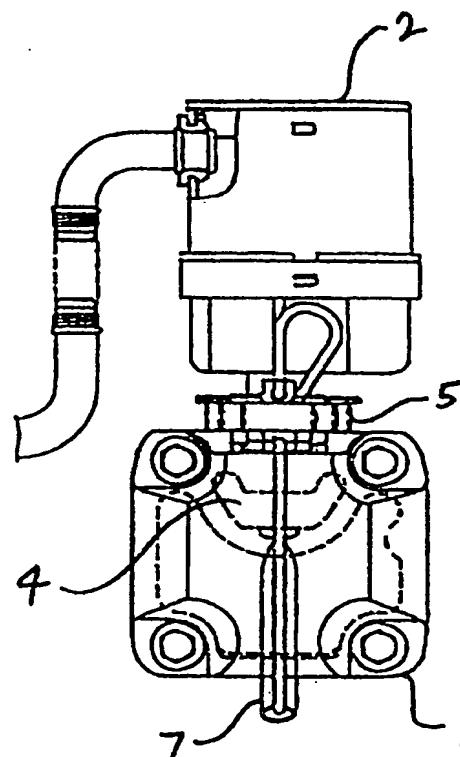
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F04B 39/12	A1	(11) International Publication Number: WO 97/41352 (43) International Publication Date: 6 November 1997 (06.11.97)
(21) International Application Number: PCT/SG97/00014		(81) Designated States: DE, GB, US.
(22) International Filing Date: 11 April 1997 (11.04.97)		Published <i>With international search report.</i>
(30) Priority Data: 9609669-8 2 May 1996 (02.05.96) SG		
(71) Applicant (<i>for all designated States except US</i>): MAT-SUSHITA REFRIGERATION INDUSTRIES (S) PTE LTD. [SG/SG]; 1 Bedok South Road, Singapore 469267 (SG).		
(72) Inventor; and (75) Inventor/Applicant (<i>for US only</i>): YAP, Wee, Beng [SG/SG]; Block 704, 71 Tampines Street #03-44, Singapore 520704 (SG).		
(74) Agents: HO, Ying, Dat et al.; Lawrence Y.D. Ho, Thong sia Building, 30 Bideford Road #07-02/03, Singapore 229922 (SG).		

(54) Title: CYLINDER HEAD-SUCTION MUFFLER ASSEMBLY FOR HERMETIC COMPRESSOR

(57) Abstract

An improved cylinder head-suction muffler assembly includes a suction muffler (2), a cylinder head (1), a capillary tube (7) and a self-latching clip (5). The suction muffler (2), has a suction tube (3) with a mounting block (14) and a capillary tube holder (13), and the cylinder head (1) has a suction plenum (4) and an extended portion (6) with a pair of channels (10). The self-latching clip (5) is mounted on the mounting block (14) and in the channels (10) to secure the suction muffler (2) assembly to the cylinder head (1). The self-latching clip (5) has a narrow portion (9), a wide portion (11), and a pair of bent ends (12). To couple the suction muffler (2) to the cylinder head (1) the suction tube (3) is inserted into the suction plenum (4). The capillary tube (7) is positioned in the capillary tube holder (13) and the narrow portion (9) of the self-latching clip (5) is mounted on the mounting block (14) and over the capillary tube (7) and a wide portion (11) is placed in the channels (10). The clip (5) is pushed in until the bent ends (12) are outside of the channels (10), and the clip (5) is securely in place.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

CYLINDER HEAD-SUCTION MUFFLER ASSEMBLY FOR HERMETIC COMPRESSOR

FIELD OF THE INVENTION

5

This invention relates to the field of compressors, and particularly to an improved coupling of cylinder head-suction muffler assembly in sealed reciprocating and rotary compressors for refrigeration and air conditioning.

10 BACKGROUND OF THE INVENTION

The function of sealed compressors for cooling fluids is well known in the art. Typically, an electric motor drive is built into a sealed housing or shell, and has a stator or electric armature affixed therein and a rotor assembly assembled into the cylindrical passage of the stator. This rotor assembly includes a rotor and a crankshaft which is inserted into the cylindrical passage of the rotor by interference fit. The reciprocating motion of the rotor and the piston in the compression chamber compresses low pressure gas into high pressure gas. The gas comprises typically freon or substitutes thereof. The 15 low pressure gas comes from the closed loop system and enters a suction chamber through a cylinder head - suction muffler assembly. At the suction chamber, the low pressure gas is drawn into a compression chamber during the suction stroke of the reciprocating machine. A negative vacuum pressure is created. At the same time, lubricating fluid is also drawn into the suction 20 chamber from a sump at the base of the crankshaft through a capillary tube for mixing with inert gas and lubricating the compression chamber. The compressed gas in the compression chamber is directed to the condenser of the system through a discharge valve, a discharge muffler, discharge line and 25 tube discharge.

The prior art cylinder head-suction muffler assembly comprises a suction muffler, a capillary tube, a support plate, screws, and a cylinder head. The fabrication of the cylinder head requires at least one bore and two tightening holes to be made on the cylinder head. Similarly, the installation of 5 the cylinder head to the suction muffler requires at least five steps: (1) inserting the suction tube of the suction muffler into the suction bore of the cylinder head, (2) fitting the capillary tube onto the suction muffler, (3) placing the support plate over the capillary tube and the two tightening holes, (4) inserting screws into the holes, and (5) tightening the screws. Because this 10 assembly requires threaded fasteners, the prior art cylinder head-suction muffler assembly not only requires additional machining and handling, but the process of assembling it is time and labour intensive.

In an attempt to reduce the number of threaded fasteners and the time required for assembly, a few improvements have been made in the cylinder 15 head-suction muffler assembly which are disclosed in, for instance, US patent 5,207,564, and in European Patent Publication 195,486, where a screw-less specially-designed clips were used. However, the clips in these and other prior art assembly designs incorporated complex shapes and features. In addition, some of the designs required complicated locking 20 features which needed precision in manufacturing of the parts and which required some effort to make and use. Because reduction in assembly time is a primary goal, it would be highly desirable to have components which are highly manufacturable in mass quantities, are easy to use, and are highly reliable.

25

SUMMARY OF THE INVENTION

Hence, it is the object of the present invention to provide a cylinder head-suction muffler assembly which minimizes the fabrication and

installation process while providing a reliable coupling of the parts. The improved cylinder head-suction muffler assembly includes a suction muffler, a cylinder head, a capillary tube and a self-latching clip. The suction muffler has a suction tube with a mounting block and a capillary tube holder, and the cylinder head has a suction plenum and an extended portion with a pair of channels. A self-latching clip is mounted on the mounting block and a portion of it is placed in the channels to secure the suction muffler assembly to the cylinder head. The self-latching clip has a narrow portion, a wide portion, and a pair of bent ends. To couple the suction muffler to the cylinder head, the suction tube is inserted into the suction plenum. The capillary tube is positioned in the capillary tube holder, and the narrow portion of the self-latching clip is mounted on the mounting block and over the capillary tube, and a wide portion is placed in the channels. The clip is pushed in until the bent ends are outside of the channels, and the clip is securely in place.

15

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a front view of the cylinder head-suction muffler assembly.

20

FIG. 1B is a side view of the cylinder head-suction muffler assembly.

FIG. 2A is a front view of the assembly of FIG. 1A with the cylinder head, suction muffler, capillary tube, and self-latching clip removed.

25

FIG. 2B is a front view of the assembly of FIG. 1B with the cylinder head, suction muffler, capillary tube, and self-latching clip removed.

FIG. 3 is a front view and a side view of the self-latching clip.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 1A through 2B illustrate the preferred embodiment of the present invention. The improved cylinder head-suction muffler assembly includes a discharge cylinder head 1, a suction muffler 2, a capillary tube 7 and a self-latching clip 5. As can be better seen in FIG. 2A and 2B, the cylinder head 1 includes a suction plenum 4 and an extended portion 6 which has a pair of pre-cast channels 10. The suction muffler 2 includes a suction tube 3 which is inserted into the suction plenum 4. The suction tube 3 has a mounting block 14 and a capillary tube holder 13 which holds the capillary tube 7 in place. The mounting block 14 is integrated with the suction tube 3 and the capillary tube holder 13, but is wider than the tube, and has substantially vertical side walls 14a.

The block 14 serves multiple functions. The block 14, being wider than the opening to the suction plenum 4, controls the depth of the suction tube insertion by preventing the tube from being inserted beyond the block. In addition, the width of the block 14 is such that it fits snugly into the opening of the extended portion 6, and the substantially vertical side walls 14a are adapted for fittingly receiving the self-latching clip 5. The clip 5 is placed over the mounting block 14 and around the extended portion 6 such that the clip 5 fits snugly in the channels 10. The capillary tube 7 is tightly fitted into the holder 13 and under the clip 13. The capillary tube holder 13 serves the dual function of holding the capillary tube 7 in place as well as preventing the suction tube 3 from slipping out from underneath the clip 13, and the capillary tube 7, besides performing its usual function, also serves to provide tension against the clip 5 to limit any excessive movement of the suction tube 3.

FIG. 3 illustrates the preferred embodiment of the self-latching clip 5 in detail. The clip 5 includes a narrow portion 9, a wide portion 11, a shoulder 8, and a pair of bent ends 12. The narrow portion 9 is U-shaped with sides

9a which are substantially perpendicular to the top 9b. The width of the narrow portion 9 should be about that of the mounting block 14 and should fit snugly around the block side walls 14a such that the narrow portion 9 prevents the clip holder 13 from slipping underneath the clip 5. The wide portion 11 has slanting sides 11a which are of substantially the same slope as the channels 10 on the extended portion 6 of the cylinder head 1, and should fit snugly within the channels 10. The shoulder 8, while not completely necessary, allows the clip 5 to fit better in the proper places, and provides higher spring recoil force in the wider portion 11. The bent ends 12 help to prevent the clip 5 from being inadvertently disengaged from the assembly.

The clip 5 should be made of metal which will allow it have a some elasticity such that the clip 5 can be temporarily widened to be inserted into place without losing its original shape. This property allows it to be inserted into place very quickly. To insert, the clip 5 is widened slightly so that the bent ends 12 are fitted around the channels 10. A slight pushing force is exerted on the clip until the clip 5 snaps into place with the bent ends 12 are outside of and around the channels 10 and the wide portion 11 snug in the channels 10. Although some slight movement of the suction muffler 2 is tolerated, the muffler 2 one should not be able to easily disengage the suction tube 3 from the suction plenum 4 once the clip 5 is in its proper position.

This clip has a number of advantages over other existing clips. It does not require any threaded fasteners such as screws, and can be inserted into place extremely quickly and securely. In addition, the clip can be fabricated very quickly and easily due to its simple design. Hence, the clip shortens the fabrication time of the cylinder head-suction muffler assembly. Virtually any rectangular metal strip having sufficient elasticity can be bent into shape to form the clip. The clip can be made independent of the cylinder head and the suction muffler, and few modifications are needed in the current cylinder-head design to accommodate the clip.

It should be understood by those skilled in the art that although the preferred embodiment has been described here for the purposes of fully disclosing the way to make and use the invention, various modifications can be made without completely losing the effectiveness of the present invention. For 5 instance, although the clip 5 has a shoulder 8, a slanting wide portion 11, and a U-shaped narrow portion 9, the shoulder may be eliminated. Also, the wide portion be U-shaped or the narrow portion be slanted. Various other combinations are also possible. In addition, although it is preferred that the capillary tube holder 13 act as the stopper to prevent the muffler tube from 10 slipping out, any extending flap or flange may work just as well. Furthermore, although it is preferred that the capillary tube be placed under the self-latching clip, it may be placed outside of clip without significantly affecting the assembly. Hence, various modifications, additions and substitutions are possible for the 15 invention described herein, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

CLAIMS

I claim:

1. A cylinder head-suction muffler assembly in a compressor for compressing fluids, said assembly comprising:
 3. a cylinder head having a suction plenum and an extended portion, said extended portion having a pair of channels;
 5. a suction muffler having a suction tube, said suction tube disposed inside said suction plenum;
 7. a mounting block integrated with said suction tube;
 8. a capillary tube holder for holding a capillary tube;
 9. a self-latching clip immovably fitted over said mounting block, a portion of said clip being in the channels,
 10. whereby said clip prevents said suction muffler tube from being disengaged from said suction plenum.
1. 2. The assembly as claimed in claim 1 wherein said clip has a narrow portion, a wide portion, a shoulder, and bent ends.
1. 3. The assembly as claimed in claim 2 wherein said narrow portion is U-shaped and has a top and sides with the sides being substantially perpendicular to said top.
1. 4. The assembly as claimed in claim 3 wherein said wide portion has slanting sides.
1. 5. The assembly according to claim 2 wherein said clip is made from a flat rectangular metal strip.
1. 6. The assembly according to claim 1 wherein said capillary tube is placed under the self-latching clip.

1 / 3

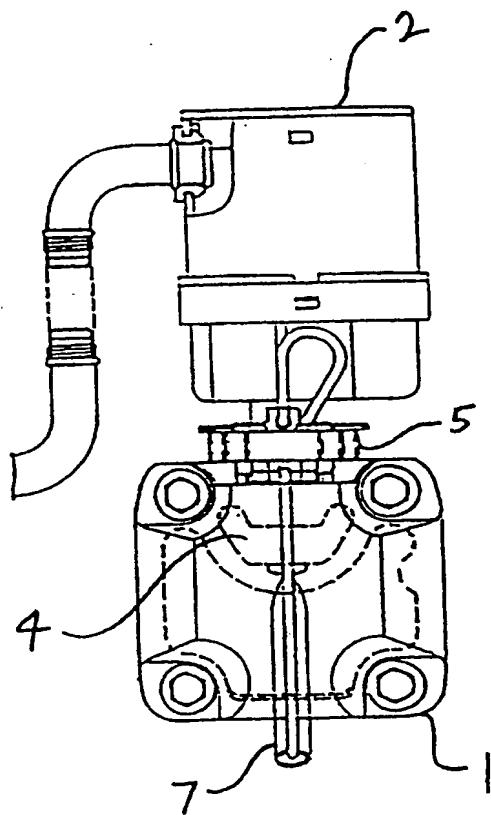


FIG 1A

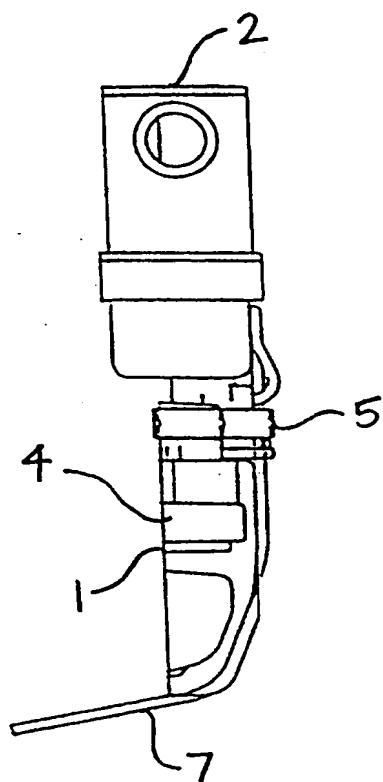


FIG 1B

2/3

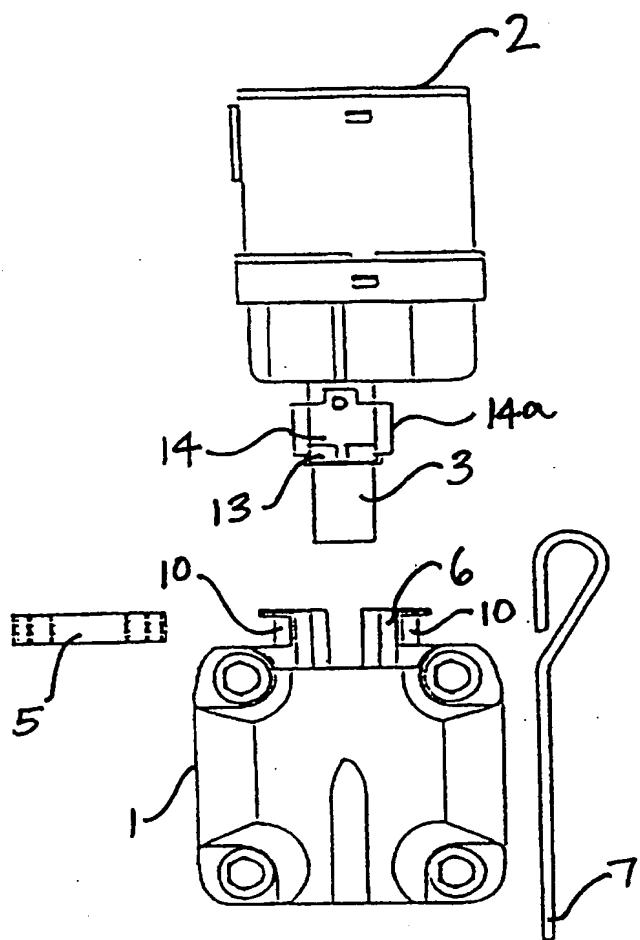


FIG 2A

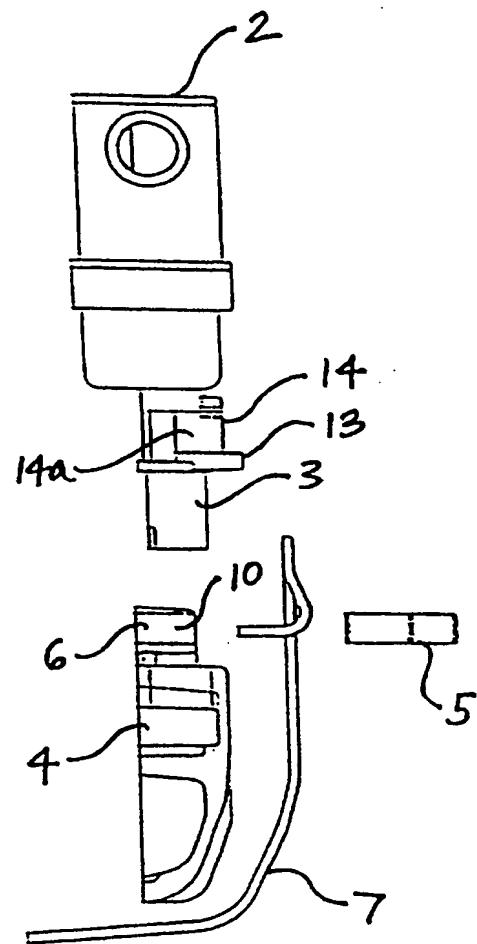


FIG 2B

3 / 3

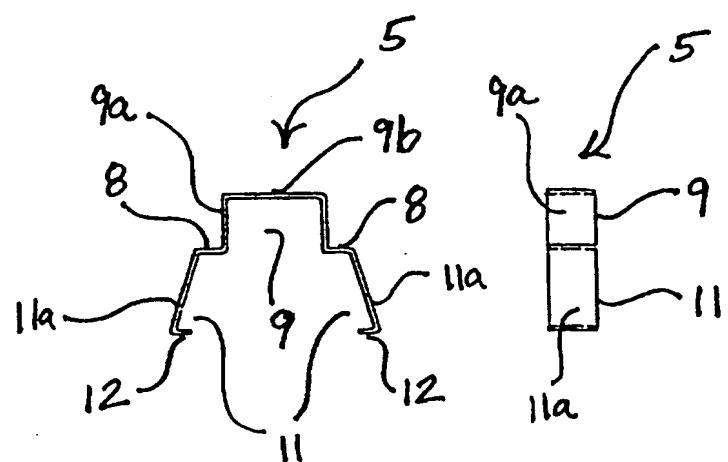


FIG 3

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/SG 97/00014

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁶: F04B 39/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC F04B 39/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC As above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT with keywords (clip:/spring/snap:)
JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5207564 A (FRITCHMAN) 4 May 1993 Figures 2-4, column 5, line 20-column 6, line 59	1 - 6
A	US 4477229 A (KROPIWNICKI et al) 16 October 1984 Figures, column 3 line 4-column 5, line 8	1 - 6
A	US 4784581 A (FRITCHMAN) 15 November 1988 Figures, column 5, lines 45-68	1 - 6

Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"
"E"	earlier document but published on or after the international filing date	"X"
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"
"O"	document referring to an oral disclosure, use, exhibition or other means	
"P"	document published prior to the international filing date but later than the priority date claimed	"&"
Date of the actual completion of the international search		Date of mailing of the international search report
6 June 1997		23 JUN 1997

Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA	Facsimile No.: (06) 285 3929
--	------------------------------

Authorized officer
R. SUBBARAYAN
Telephone No.: (06) 283 2377

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/SG 97/00014

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4313715 A (RICHARDSON, Jr.) 2 February 1982 Figures, column 2, lines 64-68	1
A	Patent Abstracts of Japan, M1212, page 83 JP 3-258980 A (MATSUSHITA REFRIG CO LTD) 19 November 1991 abstract	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/SG 97/00014

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report			Patent Family Member				
US	5207564 A	NONE					
US	4477229 A	FR	2532368	IN	161037	IN	163090
		IT	1169777	JP	59058178		
US	4784581 A	GB	2199620	IN	168548	IT	1211614
US	4313715 A	AU	65210/80	CA	1151615	GB	2066374
		JP	56104182				
END OF ANNEX							

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record.**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.